

Updated Anti-Degradation Analysis Related to Permitting Dilution Credits for an Existing NPDES Order

Order No. R5-2007-0031 (Order) permits the City of Angels (City) to make effluent discharges to Angels Creek. Limits on the effluent discharge to the creek include:

- Discharges may be made only within the period 15 November through 15 May;
- Discharged effluent must receive tertiary treatment;
- The volume of effluent discharged must not exceed five percent of the resulting downstream flow in the creek as a daily average (i.e., the resulting creek flow can be no less than 19 parts creek flow to every part of effluent discharged); and
- Effluent can be discharged only to the extent that the effluent cannot be discharged to:
 - The City's land disposal facilities because the land is wet; or
 - The City's effluent storage reservoir without encroaching into the last 20 Mgal of storage volume which are reserved to hold effluent generated in the latter half of May under very wet conditions when effluent can be neither discharged to Angels Creek, nor discharged to land because it is wet.

Based on the foregoing dilution requirement, the Regional Water Board, under the State Implementation Policy (SIP), may assign dilution credits "D" to the City's effluent discharge up to a D of 19 if 1) assigning the dilution credits will not adversely impact a downstream beneficial use of the water resource (i.e., exceed a water quality objective [WQO] for those uses), and 2) assigning the dilution credits (and the associated degradation of Angels Creek water quality) is consistent with State Water Board Resolution No. 68-16, the State's Anti-Degradation Policy.

The purpose of this anti-degradation analysis is to present information that justifies the City's request to receive dilution credits for specific constituents under both Resolution No. 68-16 and SIP. The City believes a focused anti-degradation analysis is sufficient in this situation because the discharge is not believed to be adverse to the intent and purpose of the state and federal anti-degradation policies. Specifically, 1) effluent discharges to Angels Creek have been minimized to the extent feasible; 2) effluent is treated to tertiary standards; 3) discharged effluent cannot comprise more than five percent of the resulting downstream creek flow per Department of Public Health guidance; 4) Angels Creek flows into New Melones Reservoir where substantial further dilution occurs from Stanislaus River flow into the reservoir; and 5) CEQA documents have been completed for both the General Plan, covering limited but important development within the City, and the effluent discharge to Angels Creek.

This focused anti-degradation analysis provides information related to the proposed action which will degrade Angels Creek water quality from time-to-time. The impact on water quality in New Melones Reservoir and further downstream waters is believed to be non-detectable based on the limited time, limited amount, and high quality of the proposed tertiary effluent discharge relative to the 2.4 million acre-foot storage volume of New Melones Reservoir and its annual inflow of water from the Stanislaus River. This analysis includes the following sections:

1. Documentation that Angels Creek is an EPA Tier 2 water (i.e., documentation that Angels Creek has assimilative capacity for the contaminants for which dilution credits are being requested).
2. Quantification of the extent to which water quality will be degraded from time-to-time by the proposed action of granting the requested dilution credits to the City.
3. A forecast of the important economic and social development that may occur as a result of the proposed action.
4. Documentation that the proposed degradation is needed for the important economic and social development to occur.
5. Documentation that the proposed degradation is not a result of inadequate wastewater treatment facilities and/or treatment facilities operations.
6. A discussion of alternatives to the proposed project that would reduce or eliminate the proposed degradation, including a discussion as to their infeasibility.
7. A discussion of City financial and economic matters relative to the proposed project.

ANGELS CREEK DATA

The Angels Creek data, presented in Table 1, are relevant to the City's request for dilution credits that would result in some degradation of Angels Creek water quality from time-to-time.

With background concentrations being less than the water quality objective for these constituents, Angels Creek has assimilative capacity. A water with assimilative capacity is a Tier 2 water in which some degradation relative to these constituents may be permitted, if justified. Of these six constituents, three are not conservative (i.e., they decompose over time): ammonia, bis(2-chloroethyl)ether, and dichlorobromomethane. Of the remaining three conservative constituents, lead is the most likely to bioaccumulate and potentially cause human health concerns. The WQO for lead to protect public health over a 70-year cumulative lifetime exposure with Angels Creek serving as the public's only source of food and water for 70 years is 15 µg/L. The requested average monthly effluent limit (AMEL) of 2.6 µg/L (see Table 2) based on protecting aquatic life is below the WQO of 15 µg/L for protecting human health from the cumulative effects of lead; therefore, dilution credits to protect human health from the effects of lead are not needed, and are not being requested.

Table 1
Angels Creek Water Quality Relative to Water Quality Objectives

Constituents for which dilution credits are being requested	Background Angels Creek Concentration (B) ⁽¹⁾	WQO if Effluent is Absent ⁽⁸⁾	Type of WQO	B < WQO ⁽⁹⁾
Ammonia (N), mg/L	0.09 ⁽²⁾	3.0 ⁽³⁾	Aquatic Life	Yes
Bis(2-chloroethyl)ether ⁽⁴⁾ , µg/L	<0.01 ⁽⁵⁾	0.031	Human Health	Yes
Dichlorobromomethane ⁽⁴⁾⁽⁶⁾ , µg/L	<0.2	0.56	Human Health	Yes
Copper, µg/L	1.1	1.9 ⁽⁷⁾	Aquatic Life	Yes
Lead, µg/L	0.19 ⁽²⁾	0.31 ⁽⁷⁾	Aquatic Life	Yes
Zinc, µg/L	2.0	25 ⁽⁷⁾	Aquatic Life	Yes

- (1) Background creek concentration equals maximum observed creek concentration for all constituents except carcinogens. For carcinogens, the background creek concentration is the mean of available data per SIP.
- (2) Estimated value reported below practical quantitation limit and above method detection limit.
- (3) Criterion calculated using maximum 30-day Creek temperature of 15.5° C and maximum pH of 7.8 during wet periods when effluent discharge is likely between 15 November and 15 May.
- (4) Carcinogen.
- (5) Result from sample collected October 15, 2008.
- (6) This constituent should become a non-issue if the City is able to convert the disinfection system to UV as proposed.
- (7) Based on minimum creek hardness of 16 mg/L. This hardness will increase (and therefore the WQO will increase) with any effluent discharge because the minimum effluent hardness is 39 mg/L.
- (8) The WQO may change for some constituents as a consequence of the effluent being present in the receiving water, as will be discussed.
- (9) In other words, is the receiving water Tier 2 for the constituent under consideration?

QUANTIFICATION OF THE EXTEND OF DEGRADATION

Degradation of Angels Creek water quality will be limited to periods when effluent discharges to the creek are occurring. Based on the limits placed on the effluent discharge by the Order, effluent discharge under community build-out conditions may occur for about three months each year, typically February through April, depending on rainfall patterns.

During the limited effluent discharge periods, the forecast typical and maximum extents of degradation that would occur based on requested dilution credits, requested effluent limitations, typical effluent concentrations, and Angels Creek background concentrations “B” are as estimated in Table 2 and Table 3, respectively.

Table 2
Forecast of Typical Degradation of Angels Creek from Proposed Discharge

Constituent	Dilution Credits Requested	Average Effluent Conc.	Long Term Average Creek Conc.	Typical Degradation			
				9 Months w/o Effluent Discharge		3 Months w/ Effluent Discharge	
				Creek	WQO	Average Creek w/ Effluent	Average Month WQO ⁽⁶⁾
Ammonia (N), mg/L	9.2	5.3	<0.057	None		<0.57	>5.39 ⁽¹⁾
Bis(2-chloroethyl)ether, µg/L	19	<0.12	<0.01 ⁽²⁾	None		<0.016	0.031
Dichlorobromomethane ⁽³⁾ , µg/L	19	3.2	<0.2	None		<0.35	0.56
Copper, µg/L	19	8.5	0.83	None		1.2	>2.1 ⁽⁴⁾
Lead, µg/L	19	0.58	0.15 ⁽⁵⁾	None		0.17	>0.34 ⁽⁴⁾
Zinc, µg/L	19	125	1.3 ⁽⁵⁾	None		7.5	>27 ⁽⁴⁾

(1) Criterion from Table F-5 of the Order (based on a temperature of 14.7° C and pH of 7.2).

(2) Result from sample collected October 15, 2008.

(3) This constituent should become a non-issue if the City is able to convert the disinfection system to UV as proposed.

(4) Criterion calculated using minimum mixed downstream hardness.

(5) Estimated value reported below practical quantitation limit and above method detection limit.

(6) Average month WQOs for constituents with floating WQOs (i.e., those dependent on temperature, pH, and/or hardness) are greater than the maximum month WQOs calculated for stream and effluent specific constituents presented in Table 3.

Table 3
Forecast of Maximum Degradation of Angels Creek When Discharge is Occurring

Constituent	Dilution Credits Requested	Effluent Limitations Based on Dilution Credits			Maximum Degradation			
		AMEL ⁽¹⁾	MDEL ⁽¹⁾	B ⁽²⁾	Max. Month		Max. Day	
					Creek w/Effl.	WQO ⁽¹⁾	Creek w/Effl.	WQO ⁽¹⁾
Ammonia (N), mg/L	9.2	33	56	0.09 ⁽³⁾	3.3	5.39 ⁽⁴⁾	5.6	5.6 ⁽⁴⁾
Bis(2-chloroethyl)ether ⁽⁵⁾ , µg/L	19	0.43	0.86	<0.01 ⁽⁶⁾	0.031	0.031	0.053	N/A
Dichlorobromomethane ⁽⁵⁾⁽⁷⁾ , µg/L	19	7.4	15	<0.2	0.56	0.56	0.94	N/A
Copper, µg/L	19	16	32	1.1	1.8	2.1 ⁽⁸⁾	2.7	2.7 ⁽⁸⁾
Lead, µg/L	19	2.6	5.1	0.19 ⁽³⁾	0.31	0.34 ⁽⁸⁾	0.44	8.7 ⁽⁸⁾
Zinc, µg/L	19	250	500	2.0	14	27 ⁽⁸⁾	27	27 ⁽⁸⁾

(1) AMEL = average monthly effluent limitation
MDEL = maximum daily effluent limitation
WQO = water quality objective

(2) Background creek concentration equals maximum observed creek concentration for all constituents except carcinogens. For carcinogens, the background creek concentration is the mean of available data per SIP.

(3) Estimated value reported below practical quantitation limit and above method detection limit.

(4) Criteria from Table F-5 of the Order (chronic based on a temperature of 14.7° C and pH of 7.2; acute based on pH of 8.0).

(5) Carcinogen.

(6) Result from sample collected October 15, 2008.

(7) This constituent should become a non-issue if the City is able to convert the disinfection system to UV as proposed

(8) Criterion calculated using minimum mixed downstream hardness.

As noted previously, water quality degradation in New Melones Reservoir and downstream waters is believed to be undetectable based on the limited time, limited amount, and high quality of the proposed tertiary effluent discharged relative to the 2.4 million acre-foot storage volume of New Melones Reservoir and its annual inflow of water from the Stanislaus River.

FORECAST OF ECONOMIC AND SOCIAL DEVELOPMENT

The City's request for dilution credits has two important economic and social elements to it. The first is that dilution credits are needed to serve the existing population and current level of community development. Without dilution credits, the existing community will need to provide additional source control, treatment, and/or land disposal facilities; none of which appear to be feasible financially, as will be discussed. The second is that dilution credits will allow the City to grow from a current population of approximately 3,500 to about 5,400 with an associated increase in commercial development per the desires of City residents and businesses as expressed in the City's adopted General Plan.

In general, new development, such as the Greenhorn Creek development, has attracted more affluent people to the City which currently has a median household income of \$33,371, well below the state-wide average of \$67,484 (California Department of Finance, 2007). Increased community affluence and the resulting increase in disposable income is believed to create demand for more discretionary services and therefore jobs for some of the City's unemployed residents. Both affluent people and the creation of service industry jobs reduce dependence on limited social services in the community. The General Plan also includes affordable housing requirements in an attempt to bring an overall improvement to the quality of life for all residents of the City.

DOCUMENTATION THAT THE PROPOSED DEGRADATION IS NEEDED

As noted above, without the dilution credits, 1) the City has no compliant sewer capacity to serve new development that should bring new, more affluent residents to the City, and 2) existing City residents will need to find additional source control, treatment, and/or land disposal facilities which they cannot afford as discussed under "Project Alternatives and Their Infeasibility". The City believes this discussion will demonstrate that there is no feasible alternative to the dilution credits being requested that will result in the important economic and social development sought by City residents and businesses as reflected in the City's General Plan.

DOCUMENTATION THAT THE PROPOSED DEGRADATION IS NOT A RESULT OF INADEQUATE WASTEWATER TREATMENT FACILITIES OR OPERATIONS

The City's tertiary treatment plant is not an inadequate treatment facility under any reasonable interpretation of guidance on this matter relative to state and federal anti-degradation policies. The City believes its treatment facility has performed within specifications, and therefore has no reason to believe its state-certified operators are not operating the treatment plant properly.

The City does have severe inflow/infiltration (I/I) problems with its wastewater collection system related to the age of the system, soil conditions, topography, and climate. The City has influent flow equalization to reduce the adverse effects of I/I on the treatment process. The City has on-going collection system maintenance to control I/I to the extent feasible.

PROJECT ALTERNATIVES AND THEIR INFEASIBILITY

Alternative means to achieve the important economic and social development that would reduce or eliminate the proposed degradation include the following:

- Avoidance of creek discharge and associated degradation by expanding the City's effluent storage capacity and land disposal facilities. This was the subject of a separate study (Feasibility Study for Achieving Compliance with Wastewater Permit Requirements, August 2002 and City of Angels Feasibility Study Addendum #1, February 2003) required by the Regional Water Board to justify the need for the issuance of the NPDES by documenting the infeasibility of this alternative. This study is on file with the Regional Water Board, and is included by reference in this anti-degradation analysis.
- Source control to reduce copper, lead, and zinc effluent constituents. The source of the dissolved copper, lead, and zinc in the effluent appears to be the potable water supply and its corrosion of the potable water supply piping. Though the City practices corrosion control as part of its potable water supply treatment process, these measures do not appear to be sufficient to reduce effluent metals concentrations to background levels; therefore some level of degradation appears to be inevitable unless the surface water discharge can be eliminated (infeasible as noted above), or unless the effluent stream is passed through a reverse osmosis treatment process (which is infeasible by inspection for a small, relatively poor rural community). The City is continuing to modify its potable water system corrosion control strategy in feasible ways to try to reduce corrosion, but the success of the efforts will be unknown for some time because long-term corrosion control is such a complex issue.
- Source control of dichlorobromomethane. The source of this effluent constituent is the Title 22 tertiary chlorination disinfection system. The City has designed a replacement UV system, and has arranged financing that appears to be acceptable to City residents. Therefore, it is expected that the City will be able to eliminate this source of degradation. However, the current financing for the UV improvement has time limits that may be exceeded if dilution credits are not granted by June 2009, which may not occur. Consequently, the City must ask for dichlorobromomethane dilution credits to cover the possibility that it may need these dilution credits if the current financing opportunity cannot be exercised, or if City residents reject any and all further utility expenses during the current, deepening recession.
- Source control and/or additional treatment of ammonia. The source of effluent ammonia is urea excreted by City residents. Source control of the quantity of urine entering the sewer system is infeasible.

The City has a nitrification/denitrification SBR-type activated sludge process. The City believes its state-certified operations staff is operating the process in a manner that minimizes effluent ammonia concentrations. However, City wastewater flows and strengths can be extremely varied because of the amount of I/I occurring with the City's sewer system at this elevation in the Sierra Nevada. Even with the City's influent flow equalization basins, the City does not believe it can reliably comply with the current effluent limitations without adding additional treatment processes to SBR, e.g., a separate anoxic basin ahead of the SBR so that the SBR can be operated in a more purely aerobic mode which should foster improved nitrification of ammonia released by metabolism of

urea. Again, adding a new treatment process reactor is believed to be infeasible, as will be discussed.

- Source control and/or additional treatment of bis(2-chlorethyl)ether). This chemical is fairly rare in a non-manufacturing setting because its primary use is as an intermediate chemical in the production of some pesticides. Rarer uses are as a cleaner or solvent, as an ingredient in some paints and varnishes, and as a rust inhibitor. Source control via the City's on-going public education program about what should not be flushed down toilets and sinks may not be successful in controlling the rare, random acts believed to cause this contaminant to be present in the effluent. Advanced treatment such as RO, or MF-Ozone-Peroxide-BAC could remove the contaminant when present, but is not affordable, as will be discussed.

In summary, the City believes it has demonstrated that avoiding degradation of Angels Creek by avoiding all effluent discharges to the creek is infeasible. Specifically, further expansion of the City's effluent storage and land disposal facilities is infeasible. Additionally, the City's on-going source control efforts do not appear to be capable of eliminating all degradation in Angels Creek. These programs will be continued to minimize degradation. Elimination of dichlorobromomethane degradation by conversion to UV disinfection appears to be feasible, but not to a surety warranting dropping this constituent from the request for dilution credits at this time. Advanced treatment in the form of reverse osmosis, an additional anoxic basin, and/or possibly other processes such as ion exchange, carbon adsorption, etc, realistically, are not financially feasible, as discussed below. Thus, assigning dilution credits appears to be appropriate within the intent and purpose of the state and federal anti-degradation policies.

CITY FINANCIAL ANALYSIS

The City of Angels has an estimated median household income (MHI) of \$33,371. The current monthly sewer service fee is \$71.92 and is already approved to increase to \$73.66 to cover current expenses. This fee must increase further to pay off a \$3,000,000 USDA loan to fund the current UV improvements project and to cover SSMP development and implementation costs. Funding for UV has been secured, but is time-dated and cannot be capitalized upon without a reopened/revised Order being in place by June 2009.

The current \$71.92/month (\$863.04/year) fee is 2.6 percent of the MHI, and must increase further. The current USDA guidance is that fees in excess of 2 percent of MHI represent an economic hardship on the community. A condition of hardship clearly exists in Angels. Therefore, the City believes that the current plan, which complies with WQOs and SIP, meets the economic requirements of Resolution No. 68-16. There is no discretionary money available to add further treatment to the proposed tertiary-UV treatment process.

STATE IMPLEMENTATION POLYCY (SIP)

An element of SIP is that dilution credits are to be given only to the extent that they are available and needed to achieve compliance on a constituent-specific basis. This is in concert with the intent of state and federal anti-degradation policy. Justification for the constituent-specific dilution credits being requested is presented in Table 4 based on 1) EPA's procedures for forecasting maximum effluent contaminant concentrations from limited databases, and 2) the maximum dilution credit possible under the current Order being 19.

Table 4
Basis for Dilution Credits Being Requested & Compliance Assessment with the Resulting Effluent Limitations

Constituent	Max. Observed Eff. Conc. (MEC) ⁽¹⁾	EPA Forecast Max. Eff. Conc. ⁽²⁾	Background Angels Creek Conc. Per SIP ⁽³⁾	Dilution Credits Available (D)	Dilution Credits Needed for EPA Forecast Max. Eff. Conc. ≤ Eff. Limit	Dilution Credits Being Requested	Effluent Limitations Based On Dilution Credits Being Requested		Compliance Assessment
							AMEL ⁽¹⁾	MDEL ⁽¹⁾	
Ammonia (N), mg/L	29	35	0.09 ⁽⁴⁾	19	9.2	9.2	35	56	Yes
Bis(2-chloroethyl)ether ⁽⁵⁾ , µg/L	0.32	1.2	<0.01 ⁽⁶⁾	>19 ⁽⁷⁾	55	19	0.43	0.86	Yes
Dichlorobromomethane ⁽⁵⁾⁽⁶⁾ , µg/L	4.5	17	<0.2	>19 ⁽⁷⁾	45	19	7.4	15	Yes
Copper, µg/L	10	38	1.1	19	51	19	16	32	Yes
Lead, µg/L	0.78	3.0	0.19 ⁽⁴⁾	19	24	19	2.6	5.1	Yes
Zinc, µg/L	130	490	2.0	19	40	19	250	500	Yes

(1) MEC = maximum effluent concentration observed to date.

AMEL = average monthly effluent limitation

MDEL = maximum daily effluent limitation

(2) Per *Technical Support Document for Water Quality-based Toxics Control*, March 1991.

(3) Background creek concentration equals maximum observed creek concentration for all constituents except carcinogens. For carcinogens, the background creek concentration is the mean of available data per SIP.

(4) Estimated value reported below practical quantitation limit and above method detection limit.

(5) Carcinogen

(6) Result from sample collected October 15, 2008.

(7) The dilution credit "D" available for carcinogens is the ratio of the harmonic mean flow of the receiving water during the discharge period divided by the long-term average effluent flow to be discharged to the surface water during the discharge period. The discharge period in this situation is from 15 November through 15 May. In this period a portion of the effluent flow will be discharged to Angels Creek in approximately three of the six months. If on any given day the receiving water : effluent ratio must be no less than 19:1, then over the course of the six month discharge period in which typically only three months of discharge occur, the long term average D used for carcinogens must be at least 38:1. Though the EPA forecast maximum effluent concentration for these two carcinogens would suggest that Ds in the 45 to 55 range are needed, the City is requesting only a D of 19 at this time based on the limited data for calculating a more appropriate D for carcinogens at this time.

(8) This constituent should become a non-issue if the City is able to convert the disinfection system to UV as proposed.